

REGIONAL ELECTRIC POWER TECHNOLOGY INTEGRATION AND LEVERAGING ENTERPRISE (REPTILE), Phase II

Status: Technical Success

PROBLEM / OBJECTIVE

The Regional Electric Power Technology Integration and Leveraging Enterprise (REPTILE) Phase II Program focuses on ways to implement advanced power electronics technologies into U.S. Navy ship's integrated power systems (IPS) platforms. The program as divided has four tasks.

- **Thermal Management:** Identify and implement thermal cold plate technologies into Power Conversion Modules (PCM) reducing costs, increasing power and improved reliability.
- **Fiber Optics/Condition Based Maint. (CBM):** Identify and utilize the latest optical sensors for shipboard PCMs and switchgear to implement into a condition monitoring system for CBM.
- **Manufacturing Analysis:** Leverage commercial PCM technology with the latest frame and partition cabinet manufacturing techniques to reduce weight and save space.
- **Wide Band Gap Technology:** Identify and implement the latest SiC and GaN high power semiconductor devices into PCM power electronics architecture for greater reliability.

These tasks support current and future systems such as the electric destroyer (DD(X)) and aircraft carrier (CVN-21).

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

- Identified cost savings estimated to be **18% (\$1.56M)** per Integrated Power System (IPS) ship set.
- Recommended alternative Commercial Off - The Shelf (COTS) components to reduce manufacturing costs.
- Proposed cabinet mounting scheme to reduce the size, weight, and costs of current Power Conversion Module (PCM) cabinets.

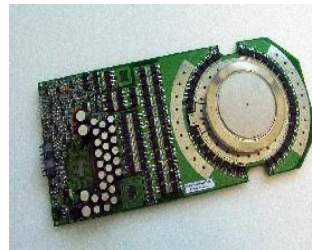


Fig.1 ETO WBG device



Fig. 2 Optic current sensor

Implementation and Technology Transfer:

- In coordination with DD(x), moving COTS voltage and current sensors to a higher TRL level with intended Navy insertion.
- Working with PCM vendor GA/SatCon, new thermal greases and cooling fluid quick disconnect fixtures simplify the PCM maintenance process and improve system performance.
- Completed Silicon Carbide Wide Band Gap technology roadmap that details the technical readiness level and forecast insertion of high power electronic devices.

Expected Benefits:

- PCM units can be manufactured for less production costs, employing COTS hardware, improved system design, and superior manufacturing processes.
- Optical sensor final deployment will provide significant weight loss to ships (tons).
- Ship systems remain operational during an emergency, based on concepts developed.

TIME LINE / MILESTONE

Start Date: September, 2002
End Date: January, 2006

FUNDING

Total Program Costs: \$ 2.4M

PARTICIPANTS

COE EMPF
NAVSEA – Philadelphia
General Atomics/SatCon